CLAIMS

We claim:

1. A process for welding duplex stainless steel parts comprising carrying out welding in the presence of a high refractory flux thereby forming a weld bead having a duplex stainless steel phase structure.

2. The process of claim 1, wherein the refractory flux comprises at least one of silica, titania, magnesia, chromia and TiO.

3. The process of claim 2, wherein the refractory flux comprises a mixture of Cr_2O_3, SiO_2 and an oxide of titanium.

4. The process of claim 1, wherein welding is accomplished by arc welding using a non-pulsed electrical arc.

5. A process comprising arc welding duplex stainless steel tubing using heat generated by a non-pulsed electric current in the presence of a refractory flux to form a weld bead with a duplex stainless steel phase structure and a uniform profile.

6. The process of claim 5, wherein the weld bead has a penetration characteristic of 0.33 or greater.

7. The process of claim 6, wherein the arc welding process is arc welding carried out in an enclosed system so as to shield the gap between the electrode producing the arc and the tubing being welded from atmospheric oxygen.

8. The process of claim 7, wherein the gap is flushed with a shield gas non-reactive with the weld pool and high refractory flux.

9. The process of claim 8, wherein the shield gas is inert gas helium, argon, neon zenon or mixtures thereof.

10. The process of claim 9, wherein additional alloying elements are supplied to the weld pool formed during welding by a weld filler having a higher nickel content than the metal forming the duplex steel to be welded.

11. The process of claim 8, wherein additional alloying elements are supplied to the weld pool formed during welding by a weld filler having a higher nickel content than the metal forming the duplex steel to be welded.

12. The process of claim 11, wherein the refractory flux comprises at least one of silica, titania, magnesia, chromia and TiO.

13. The process of claim 12, wherein the refractory flux comprises a mixture of Cr_2O_3, SiO_2 and an oxide of titanium.

14. The process of claim 8, wherein said welding step is completed in a single pass orbital weld.

15. The process of claim 14, wherein a weld ring formed from a weld filler material is placed between tube ends to be welded.

16. The process of claim 15, wherein the weld ring is T-shaped in cross section so that the ring can be slipped onto a tube end.

17. The process of claim 16, wherein the flux is applied to an outer surface of the weld ring.

18. The process of claim 5, wherein the refractory flux comprises at least one of silica, titania, magnesia, chromia and TiO.

19. The process of claim 14, wherein the refractory flux comprises a mixture of Cr_2O_3, SiO_2 and an oxide of titanium.

20. The process of claim 5, wherein said welding step is completed in a single pass orbital weld.

21. The process of claim 20, wherein a weld ring formed from a weld filler material is placed between tube ends to be welded.

22. The process of claim 21, wherein the weld ring is T-shaped in cross section so that the ring can be slipped onto a tube end.

23. The process of claim 22, wherein the flux is applied to an outer surface of the weld ring.

24. An insert for welding duplex stainless steel tubing, comprising:

a) a weld ring comprising higher % weight Ni compared to the duplex stainless steel tubing being welded; and

b) a penetration improving flux on an outer surface of said weld ring.

25. The insert of claim 24, wherein the flux is applied to an outer surface of the weld ring after the ring is formed.

26. The insert of claim 24, wherein said flux is part of the weld ring metal matrix.

27. The insert of claim 24, wherein said filler material comprises 25.10.4.L material.

28. The insert of claim 24, wherein said flux comprises a titanium oxide.

29. An orbital welding process for joining adjacent ends of two heavy wall duplex stainless steel tubes comprising

(a) placing a weld filler between the adjacent tube ends to be welded, the weld filler selected so that the weld bead formed by the welding process has a duplex phase structure,

(b) applying a high refractory flux to the heat affect zone formed by the weld filler and the adjacent tube ends to be welded, and

(c) arc welding the adjacent tube ends together in a single orbital pass using a non-pulsed arc.

30. The process of claim 29, wherein the weld filler is made from a steel containing more austenite than the duplex steel tubes being welded together.

31. The process of claim 30, wherein the filler steel contains more nickel than the forming the duplex steel tubes being welded together.

32. The process of claim 29, wherein the flux includes a metal oxide.

33. The process of claim 29, wherein the weld filler is a weld ring having a T-shaped cross section.

34. The process of claim 29, wherein the arc is continuous.

35. An orbital welding process for joining adjacent ends of two heavy wall duplex stainless steel tubes comprising

(a) applying a high refractory flux to the heat affect zone formed by the adjacent tube ends to be welded, and

(b) arc welding the adjacent tube ends together in a single orbital pass using a non-pulsed arc.

36. The process of claim 29, wherein the flux includes at least one of silica, titania, magnesia, chromia and a titanium oxide.

37. The process of claim 36, wherein the refractory flux comprises a mixture of Cr_2O_3, SiO_2 and an oxide of titanium.

38. The process of claim 37, wherein the refractory flux comprises a mixture of about 30 to 70 wt.% of a titanium dioxide, about 20 to 76 wt.% Cr_2O_3, and about 5 to 27 wt.% SiO_2.

39. The process of claim 38, wherein the wall thickness of the tubing being welded is greater than 2 mm.

40. The process of claim 36, wherein the wall thickness of the tubing being welded is greater than 2 mm.

41. The process of claim 35, wherein the wall thickness of the tubing being welded is greater than 2 mm.

42. The process of claim 35, wherein a weld filler made from a steel containing more austenite than the duplex steel tubes being welded together is placed between the adjacent tube ends to be welded. .

43. The process of claim 42, wherein the weld filler contains more nickel than the duplex steel forming the tubes being welded together.